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An opinion survey based assessment of renewable energy technology development in India

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Abstract

India has a very large potential for harnessing renewable energy sources. However, there is a large gap between the estimated potential and the cumulative achievements made so far. A variety of reasons are attributed to the current low levels of dissemination of renewable energy technologies in India as against their respective estimated potentials. Several of these attributes could, one way or the other, be related to the current status of development of the technology, its appropriateness and dissemination strategies adopted for their diffusion and deployment. Results of an attempt to assess the current status of some renewable energy technologies in India are briefly presented in this paper. The main findings of a structured questionnaire based survey undertaken for eliciting views of different categories of stakeholders on various issues affecting dissemination of renewable energy technologies in India are presented in this paper.
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Keywords: Renewable energy technology; Opinion survey; Barriers affecting dissemination

Contents

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1. Introduction

Development of viable renewable energy technologies is of crucial importance for providing sustainable alternatives of energy supply. There is a large gap between the maximum estimates for utilization potential of many renewable energy technologies in India and their current reported levels of dissemination (Table 1). Such a mismatch, in spite of considerable initiatives taken by the government over the last three decades, certainly necessitates a proper in-depth evaluation of the possible causes (and also their remedial measures, if any) of the poor dissemination of renewable energy technologies in the country. As a modest attempt in this direction, the findings of a questionnaire based survey undertaken to seek the opinion of different stakeholders (experts, officials of government ministries, state nodal agencies[1], researchers, NGOs, internationally funded institutions[2] etc.) on a variety of issues related to the dissemination of renewable energy technologies in the country are presented in this paper.

2. Methodology

A structured questionnaire was developed to seek the opinions of different stakeholders on the current status of development of the renewable energy technologies in India as well as other related issues. The questionnaires were mailed in electronic form and also as hard copies to about 400 professionals directly linked with the planning, design, development, and dissemination of renewable energy technologies in the country. These included university teachers, researchers, manufacturers and professionals working in NGOs, government and internationally funded institutions.

The questionnaire sought opinion of the respondents on the following issues:

(a) the estimates available in the literature regarding the utilization potential of five renewable energy technologies in India,
(b) the relative role of various barriers affecting dissemination,
(c) user friendliness, need satisfaction, availability of spare parts and facilities for repair and maintenance of the renewable energy technologies,
(d) desirability of giving financial and fiscal incentives, and
(e) the potential/desired role of various institutions in the development and dissemination of renewable energy technologies in the country.

Two approaches were used for indicating the responses (i) tick marks and (ii) relative ranking of specified attributes and factors. The tick marks were used for indicating responses for the utilization potential of renewable energy technologies, assessment of technology for user friendliness, meeting user's requirement and availability of sales service and spare parts for each of the technologies and possible financial and fiscal incentives. The relative ranking mechanism was used for assessing barriers affecting the dissemination of renewable energy technologies and the potential/desired role of institutions involved in design, development and dissemination of technologies in the country. For example, the

[1]State nodal agencies are administratively controlled by the state government but are dependent on MNES for financial support.

[2]Include Asian Development Bank, the World Bank, UNDP, etc.

Table 1
Estimated utilization potential of renewable energy technologies in India

Technology	Units	Potential	Cumulative dissemination (upto December 2004)	Source[a] (for potential)
Biogas plants	Number of households (million)	12	3.37	[1]
		29		[2]
Improved cook stoves	Number of households (million)	120	33.9	[3]
		90		[2]
Box type solar cookers	Number of households (million)	75	0.55	[2]
Domestic solar water heaters	Collector area (million m^2)	140	0.80	[1]
	Number of households (million)	45	–[b]	[4]
Solar photovoltaic lanterns	Number of households (million)	15	0.26	Preliminary estimates of the authors

[a]As reported in MNES publications.
[b]Data not available.

respondents were requested to rank the barriers as per their perceived importance and the same was to be indicated by grading them as extremely important, very important, important, less important and not important. In order to assess the potential role and efficacy of various institutional mechanisms of dissemination of renewable energy technologies, questions were also posed to elicit opinion on the desirable role of various institutions involved in the dissemination of renewable energy technologies in the country.

The present study, included five renewable energy technologies viz., biogas plants (family size), improved cook stoves, box type solar cookers, solar water heating systems and solar photovoltaic lanterns.

3. Results and discussion

Only about one fourth of the total professionals contacted for the survey finally responded to the questionnaire (Fig. 1). Moreover, many of the respondents have answered selectively leaving some of the questions unanswered. This being an opinion survey, the responses were analyzed to provide the percentage of the respondents agreeing/supporting a particular viewpoint for each of the items included in the questionnaire. Therefore, the results presented in this section are essentially limited to identification and highlighting of any glaring differences in the opinions of the respondents.

Table 2 summarizes the responses on the estimated utilization potential of five renewable energy technologies included in the questionnaire. In case of biogas plants about 60% respondents disagree with the utilization potential listed in Table 1. While almost 50% of these disagreeing respondents consider it to be an overestimation, in the opinion of other half of them it is an underestimate. This certainly necessitates the development of a comprehensive method/framework for identification of niche areas using biogas

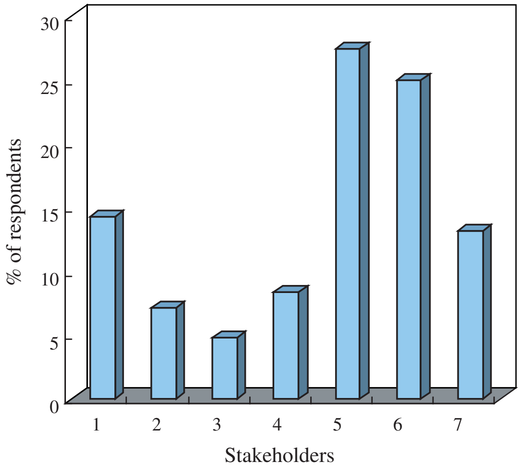


Fig. 1. Breakup of the respondents to the questionnaire.

Table 2
Summary of the responses on the utilization potential of some renewable energy technologies in India (responses in %)

S. No.	Opinion about the potential estimates	Biogas plants	Improved cook stoves	Box type solar cookers	Domestic solar water heaters	Solar photovoltaic lanterns
1	Highly under estimated	3.0	3.1	3.0	4.1	2.7
2	Under estimated	25.8	7.7	3.0	11.0	22.7
3	Realistic	40.9	61.5	55.2	64.4	57.3
4	Over estimated	27.3	27.7	34.3	17.8	14.7
5	Highly over estimated	3.0	0.0	4.5	2.7	2.6

technology in the country and eventually a realistic estimation of the overall utilization potential of biogas technology as given in Table 1. In the case of improved cook stoves, 61.5% respondents opine that the utilization potential is realistic. A majority of the disagreeing respondents consider that the potential of using 120 million improved cook stoves in the country is an overestimate. It is appropriate to mention that the reported dissemination of improved cook stoves in the country by December 2002 is 33.9 million as against the estimated utilization potential of 120 million.

In the opinion of about 55% respondents the estimated potential of 75 million box type solar cookers is realistic but over 34% of the respondents consider it to be an overestimate. A reported dissemination of around 0.55 million box type solar cookers in about 20 years of promotion initiated by the central and state government appears to support the opinion of the later group of respondents. About 64% of the respondents consider the potential estimate of 45 million households for using domestic solar water heating systems as

realistic. However, the current level of dissemination of these systems in the country being rather low, attempts should be made to identify niche areas and also to formulate and implement suitable promotion strategies.

Maximum disagreement (59.1% respondents) with the utilization potential has been noticed in case of biogas plants followed by box type solar cookers (44.8% respondents), solar photovoltaic lanterns (42.7% respondents), improved cook stoves (38.5% respondents) and domestic solar water heating systems (35.6% respondents) in this order. Except in case of solar photovoltaic lanterns majority of the disagreed respondents consider the listed utilization potentials to be overestimates for all the five technologies considered in the study. Such a response may primarily be attributed to the general tendency of the promoters of renewable energy technologies to quote the utilization potentials on the higher side.

Table 3 summarizes the responses received on the current status of some of the renewable energy technologies in the country. The respondents were requested to give their opinion on three attributes of the technologies. The first one related to the userfriendliness of the technology in terms of its operation, repair and maintenance. The second attribute essentially corresponded to the satisfaction of the users of renewable energy technology with regard to its specified output. The availability of spare parts and servicing facility was covered under the third attribute. A preliminary analysis of the responses received in the case of biogas plants reveals that in the opinion of about 44% respondents biogas technology is a 'Very Good' user friendly technology. On the user's satisfaction front, about the same percentage of respondents consider it to be 'Good'. However, with respect to the availability of spare parts and repair and maintenance services, even for the biogas technology with more than 3.65 million biogas plants reportedly installed in the country, about 50% respondents rate it as 'Average' or 'Poor'. The response in the case of improved cook stoves is similar to that received for biogas plants.

The box type solar cookers have received relatively inferior rankings in all the three attributes of user friendliness, user's satisfaction and availability of spares and repair and maintenance facility. The poor dissemination of box type solar cooker in the country can perhaps be explained on these grounds. For other renewable energy technologies covered in the survey also the availability of spares and repair and maintenance facility appears to be the most poorly rated attribute.

Tables 4a–e present a summary of the responses on the barriers affecting the development and dissemination of renewable energy technologies considered in the study. As expected, most of the respondents consider each of the barriers listed in Tables 4a–e as 'Important' or even superior. Owing to a relatively small size of respondents it may not be possible to arrive at specific conclusions and some broad directions only can be presented. In the opinion of 58% of the respondents, for family size biogas plants, the resource availability is an extremely important barrier. Therefore, prior to the installation of biogas plants, proper resource assessment is necessary to ensure long-term feedstock availability.

For solar energy technologies and biogas plants the resource availability as well as the appropriateness of the technology has been considered quite important. The financial and economic viability and awareness and user's training are next two important considerations. The socio-cultural acceptability is rated to be relatively more important in cases of family size biogas plants, improved cook stoves and box type solar cookers as compared to solar water heating systems and solar photovoltaic technologies reflecting better societal acceptance of the later technologies.

Table 3
Opinion of the respondents on three technological attributes of RETs

Technology	Opinion of the respondents	Responses in %		
		User friendliness	User's satisfaction	Availability of sales/services
Biogas plants	Excellent	9.8	8.7	4.6
	Very good	43.7	26.1	9.2
	Good	28.2	42.0	36.9
	Average	16.9	17.4	38.5
	Poor	1.4	5.8	10.8
Improved cook stoves	Excellent	12.7	5.8	3.2
	Very good	38.0	29.0	16.1
	Good	31.0	40.6	32.3
	Average	11.3	21.7	33.9
	Poor	7.0	2.9	14.5
Box type solar cookers	Excellent	7.1	5.8	0.0
	Very good	30.0	17.4	16.2
	Good	32.9	21.7	24.2
	Average	21.4	46.4	43.5
	Poor	8.6	8.7	16.1
Domestic solar water heaters	Excellent	17.3	17.9	1.4
	Very good	32.2	29.5	24.3
	Good	33.3	28.2	20.3
	Average	16.0	24.4	40.5
	Poor	1.2	0.0	13.5
Solar photovoltaic lanterns	Excellent	16.9	12.3	1.3
	Very good	31.3	39.0	6.6
	Good	33.7	31.7	38.2
	Average	18.1	14.6	34.2
	Poor	0	2.4	19.7

Tables 5a–h briefly summarize the responses received on the desirable role of various institutions towards large scale dissemination of renewable energy technologies in the country. The different possible roles listed in the questionnaire included centralized and decentralized planning, programme implementation, quality control, performance monitoring and feedback evaluation, human resource development, technology development and transfer, awareness generation and market development. The institutions mentioned in the questionnaire were the Ministry of Non-conventional Energy Sources (MNES), state nodal agencies, public sector undertakings (such as Indian Renewable Energy Development Agency Limited, Bharat Heavy Electricals Limited, Central Electronics Limited, etc.), Non-Governmental Organizations (Tata Energy Resources Institute, Centre for Science and Environment, Development Alternatives, National Council of Applied Economic Research), educational institutions (such as universities, Indian Institute(s)Technology, National Institute(s) of Technology, Indira Gandhi

Table 4a
Assessment of barriers affecting the promotion of some renewable energy technologies: biogas plants (family size)

Barriers	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Resource availability	58.0	20.4	13.0	7.2	1.4
Appropriateness of the technology	38.8	40.3	17.9	3.0	0.0
Financial and economic viability	17.4	13.0	52.2	10.2	7.2
Energetic feasibility	32.8	13.1	36.1	13.1	4.9
Socio-cultural acceptability	32.8	44.8	10.4	6.0	6.0
Environmental sustainability	50.8	27.7	12.3	7.7	1.5
Institutional preparedness	18.2	16.7	54.5	9.1	1.5
Awareness and user's training	35.3	38.2	23.5	1.5	1.5
Availability of after sales and services	42.6	26.5	14.7	14.7	1.5

Table 4b
Assessment of barriers affecting the promotion of some renewable energy technologies: improved cook stoves

Barriers	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Resource availability	29.2	18.5	20.0	18.5	13.8
Appropriateness of the technology	35.4	33.8	27.7	3.1	0.0
Financial and economic viability	15.2	7.6	54.5	13.6	9.1
Energetic feasibility	25.4	15.3	35.6	20.3	3.4
Socio-cultural acceptability	23.4	48.4	15.6	9.4	3.2
Environmental sustainability	32.3	24.2	33.9	8.1	1.5
Institutional preparedness	7.8	20.3	51.6	20.3	0.0
Awareness and user's training	30.3	25.8	33.3	9.1	1.5
Availability of after sales and services	22.2	30.2	20.6	25.4	1.6

Institute of Development Research), research and development centres (such as Council for Scientific and Industrial Research and Indian Council of Agricultural Research laboratories,), internationally funded institutions (such as Asian Development Bank, the World Bank, United Nations Development Programme, United Nations Education and Scientific Cultural Organization) and manufacturers of renewable energy technologies. The Bureau of Indian Standards (BIS) was also included in this list.

Table 4c
Assessment of barriers affecting the promotion of some renewable energy technologies: box type solar cookers

Barriers	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Resource availability	37.1	16.1	25.8	12.9	8.1
Appropriateness of the technology	31.7	46.1	14.3	7.9	0.0
Financial and economic viability	16.1	19.4	50.0	14.5	0.0
Energetic feasibility	25.0	21.4	37.5	12.5	3.6
Socio-cultural acceptability	24.2	35.5	25.8	11.3	3.2
Environmental sustainability	25.0	28.3	23.4	15.0	8.3
Institutional preparedness	9.8	23.0	45.9	19.7	1.6
Awareness and user's training	24.6	26.2	41.0	8.2	0.0
Availability of after sales and services	23.3	26.7	25.0	25.0	0.0

Table 4d
Assessment of barriers affecting the promotion of some renewable energy technologies: domestic solar water heaters

Barriers	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Resource availability	33.8	37.8	20.3	5.4	2.7
Appropriateness of the technology	52.0	37.3	10.7	0.0	0.0
Financial and economic viability	36.5	37.8	21.6	4.1	0.0
Energetic feasibility	24.6	33.8	32.3	6.2	3.1
Socio-cultural acceptability	12.3	21.9	31.5	27.5	6.8
Environmental sustainability	17.1	18.6	30.0	24.3	10.0
Institutional preparedness	24.7	31.5	32.9	8.2	2.7
Awareness and user's training	26.3	32.9	35.6	3.9	1.3
Availability of after sales and services	41.1	31.6	20.5	6.8	0.0

As per the responses received, a manufacturer of renewable energy technologies can primarily contribute to (a) technology development, (b) quality control and standardization, (c) market development and (d) programme implementation. They are also expected to contribute moderately to awareness generation and users' training as well as performance monitoring and feedback evaluation. As expected the Bureau of Indian Standard (BIS) is supposed to primarily contribute to quality control and standardization

Table 4e
Assessment of barriers affecting the promotion of some renewable energy technologies: solar photovoltaic lanterns

Barriers	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Resource availability	36.8	26.3	23.7	11.8	1.4
Appropriateness of the technology	41.0	38.5	11.5	7.7	1.3
Financial and economic viability	33.8	32.5	26.0	6.5	1.2
Energetic feasibility	36.4	16.7	27.3	19.6	0.0
Socio-cultural acceptability	17.6	29.7	24.3	17.6	10.8
Environmental sustainability	23.3	24.7	21.9	20.5	9.6
Institutional preparedness	13.5	39.2	33.8	10.8	2.7
Awareness and user's training	30.3	40.8	21.1	7.8	0.0
Availability of after sales and services	50.0	22.3	21.1	6.6	0.0

Table 5a
Relative importance of the role(s) of stakeholders involved in development and promotion of renewable energy technologies: manufacturers of renewable energy technologies

Role of institution(s)	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Centralized planning	17.6	27.9	27.9	13.2	13.4
Decentralized planning	11.8	52.9	16.2	8.8	10.3
Implementation of programmes	31.9	44.9	13.0	2.9	7.3
Quality control and standardization	41.3	41.3	14.7	2.7	0.0
Performance monitoring and feedback mechanism	26.0	37.0	23.3	12.3	1.4
Human resource development	20.5	5.6	28.8	12.4	2.7
Technology development	60.8	27.0	9.5	2.7	0.0
Technology transfer	38.7	36.0	16.0	9.3	0.0
Awareness generation and information dissemination	24.7	34.2	32.9	5.5	2.7
Market development	68.4	22.4	9.2	0.0	0.0

of renewable energy technologies and also towards performance monitoring and feedback assessment. NGOs are expected to share a greater responsibility in large-scale dissemination of renewable energy technologies. They are expected to contribute to awareness generation and user's training, programme implementation, decentralized

Table 5b
Relative importance of the role(s) of stakeholders involved in development and promotion of renewable energy technologies: Bureau of Indian Standards

Role of institution(s)	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Centralized planning	16.9	12.3	16.9	24.6	29.3
Decentralized planning	1.5	15.4	30.8	21.5	30.8
Implementation of programmes	0.0	18.2	22.7	18.2	40.9
Quality control and standardization	85.3	10.7	1.4	1.3	1.3
Performance monitoring and feedback mechanism	23.3	19.2	20.5	19.2	17.8
Human resource development	2.9	17.6	33.8	29.5	16.2
Technology development	15.5	18.3	28.2	23.9	14.1
Technology transfer	8.6	25.7	18.6	27.2	20.0
Awareness generation and information dissemination	11.6	26.1	17.4	23.2	21.7
Market development	7.1	15.7	20.0	27.1	30.0

Table 5c
Relative importance of the role(s) of stakeholders involved in development and promotion of renewable energy technologies: NGOs

Role of institution(s)	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Centralized planning	10.8	16.9	40.0	23.1	9.2
Decentralized planning	35.3	32.4	16.2	11.8	4.3
Implementation of programmes	56.2	28.8	8.2	4.1	2.7
Quality control and standardization	19.1	29.4	30.9	13.2	7.4
Performance monitoring and feedback mechanism	35.6	34.2	21.9	5.6	2.7
Human resource development	32.4	45.9	14.9	2.7	4.1
Technology development	18.6	35.7	31.4	5.7	8.6
Technology transfer	33.8	36.8	14.7	7.4	7.3
Awareness generation and information dissemination	61.8	21.1	14.5	0.0	2.6
Market development	36.0	42.7	14.7	1.3	5.3

planning, performance monitoring, market development, technology transfer and human resource development. The possibility of having close interaction between the NGOs and the potential users can explain the above opinion of respondents.

Table 5d
Relative importance of the role(s) of stakeholders involved in development and promotion of renewable energy technologies: Universities and Educational Institutions

Role of institution(s)	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Centralized planning	13.2	8.8	38.2	27.9	11.9
Decentralized planning	5.9	22.1	32.4	29.4	10.2
Implementation of programmes	5.7	28.6	34.3	25.7	5.7
Quality control and standardization	18.8	34.8	33.4	11.6	1.4
Performance monitoring and feedback mechanism	15.7	28.6	40.0	11.4	4.3
Human resource development	39.4	36.6	18.4	5.6	0.0
Technology development	53.3	38.7	6.7	1.3	0.0
Technology transfer	40.5	41.9	16.2	1.4	0.0
Awareness generation and information dissemination	18.7	41.3	32.0	5.3	2.7
Market development	9.9	7.0	43.7	28.2	11.2

Table 5e
Relative importance of the role(s) of stakeholders involved in development and promotion of renewable energy technologies: state nodal agencies

Role of institution(s)	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Centralized planning	20.0	25.7	34.3	14.3	5.7
Decentralized planning	52.0	24.0	20.0	2.7	1.3
Implementation of programmes	60.5	30.3	7.9	1.3	0.0
Quality control and standardization	23.9	45.1	22.5	8.5	0.0
Performance monitoring and feedback mechanism	33.3	44.0	22.7	0.0	0.0
Human resource development	37.7	33.8	19.5	7.8	1.2
Technology development	12.5	45.8	25.0	13.9	2.8
Technology transfer	18.9	39.2	25.7	12.2	4.0
Awareness generation and information dissemination	54.7	32.0	9.3	1.3	2.7
Market development	46.8	31.2	13.0	6.5	2.5

The educational institutions and research and development centres can primarily contribute to (a) technology development and transfer, and (b) human resource development. Moderate contributions towards quality control and standardization, awareness generation and users training and centralized planning are also expected from them.

Table 5f
Relative importance of the role(s) of stakeholders involved in development and promotion of renewable energy technologies: Ministry of Non-conventional Energy Sources

Role of institution(s)	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Centralized planning	78.5	12.7	8.8	0.0	0.0
Decentralized planning	22.2	47.2	23.6	5.6	1.4
Implementation of programmes	43.8	30.1	23.3	1.4	1.4
Quality control and standardization	37.8	40.5	20.3	0.0	1.4
Performance monitoring and feedback mechanism	29.4	40.0	25.3	4.0	1.3
Human resource development	33.8	32.4	27.0	4.1	2.7
Technology development	51.9	32.5	13.0	1.3	1.3
Technology transfer	32.5	37.7	24.7	2.6	2.5
Awareness generation and information dissemination	40.3	42.9	13.0	2.6	1.2
Market development	35.9	30.8	20.5	10.3	2.5

Table 5g
Relative importance of the role(s) of stakeholders involved in development and promotion of renewable energy technologies: public sector undertakings

Role of institution(s)	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Centralized planning	25.4	28.2	39.4	2.8	4.2
Decentralized planning	23.9	25.4	38.8	7.5	4.4
Implementation of programmes	32.9	41.4	22.9	1.4	1.4
Quality control and standardization	22.4	32.8	38.8	4.5	1.5
Performance monitoring and feedback mechanism	14.9	44.8	34.3	3.0	3.0
Human resource development	19.7	46.5	26.8	5.6	1.4
Technology development	33.4	42.0	18.8	2.9	2.9
Technology transfer	32.9	34.3	27.1	5.7	0.0
Awareness generation and information dissemination	28.8	38.4	20.5	9.6	2.7
Market development	36.8	40.8	17.1	2.7	2.6

The state nodal agencies are expected to play an extremely important role in the implementation of various programmes on renewable energy technologies. In addition, they are also expected to contribute to performance monitoring, awareness generation and users training, and market development.

Table 5h
Relative importance of the role(s) of stakeholders involved in development and promotion of renewable energy technologies: internationally funded institutions

Role of institution(s)	Responses in %				
	Extremely important	Very important	Important	Less important	Not important
Centralized planning	17.4	20.3	23.2	14.5	24.6
Decentralized planning	7.2	15.9	31.9	20.3	24.7
Implementation of programmes	22.1	22.0	17.6	30.9	7.4
Quality control and standardization	12.9	25.7	20.0	35.7	5.7
Performance monitoring and feedback mechanism	14.5	27.5	27.6	29.0	1.4
Human resource development	16.4	28.8	30.1	19.2	5.5
Technology development	24.3	31.1	21.6	20.3	2.7
Technology transfer	36.8	18.5	23.7	19.7	1.3
Awareness generation and information dissemination	29.3	20.0	25.3	22.7	2.7
Market development	26.0	15.1	31.5	16.4	11.0

Table 6
Feedback on possible financial and fiscal incentives for promotion of renewable energy technologies in India (responses in %)

S. No.	Type of incentive(s)	Biogas plants	Improved cook stoves	Box type solar cookers	Domestic solar water heaters	Solar photovoltaic lanterns
1	Capital subsidy	35.2	36.6	35.2	36.6	50.7
2	Low interest loan	36.6	15.5	28.2	49.3	43.7
3	Accelerated depreciation related income tax benefits	5.6	1.4	1.4	18.3	9.9
4	Income tax benefits on the interest paid for loan amount	9.9	1.4	5.6	31.0	8.5
5	Income tax benefits on capital gain investments	0.0	0.0	0.0	21.1	5.6
6	None	15.2	25.4	19.7	2.8	11.3

The Ministry of Non-conventional Energy Sources (MNES) is expected to contribute to all the facets of renewable energy technology development and dissemination. Such a response clearly reflects the pivotal role so far assigned to the MNES in this regard. As the only country with a full fledged ministry for this cause it is obvious that the same is expected to have a role in each and every dimension of the primary objective of large scale dissemination of renewable energy technologies in the country. However, for effective and

efficient formulation and implementation of suitable strategies for development and dissemination of renewable energy technologies in the country in the long-term it may be desirable to redefine the roles and responsibilities of MNES as well as its linkages with other potentially contributing institutional mechanisms in the country.

Opinion and views were also sought on the suitability of possible single or combination of financial and/ or fiscal incentives for promotion of renewable energy technologies. Only about 35% respondents recommend the provision of capital subsidy on biogas plants, improved cook stoves, box type solar cookers and domestic solar water heaters (Table 6). More respondents (over 50%) suggest the same for photovoltaic systems. The provision of low interest loan has been suggested for biogas plants, domestic solar water heaters and photovoltaic systems. As expected, the proposed incentives of income tax benefits on accelerated depreciation, capital gain investments and interest paid on a commercial loan have not been found suitable for the potential users of biogas plants, improved cook stoves and box type solar cookers.

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